

Body Tissues

Introduction to the Specialization
of the Human Body

Introduction to Tissues

- A ***tissue*** is composed of similar cells that are specialized to perform a common function(s).
- There are 4 adult primary tissues:
(Abbreviation, function)
 - 1.) Epithelial Tissue (ET, covering or lining)
 - 2.) Connective Tissue (CT, support)
 - 3.) Muscle Tissue (MT, movement)
 - 4.) Nervous Tissue (NT, control)

Introduction to Tissues

- These four primary tissues are derived from three embryonic germ layers.
- A ***germ layer*** is the cell or grouping of cells that differentiate in the process of fetal development.

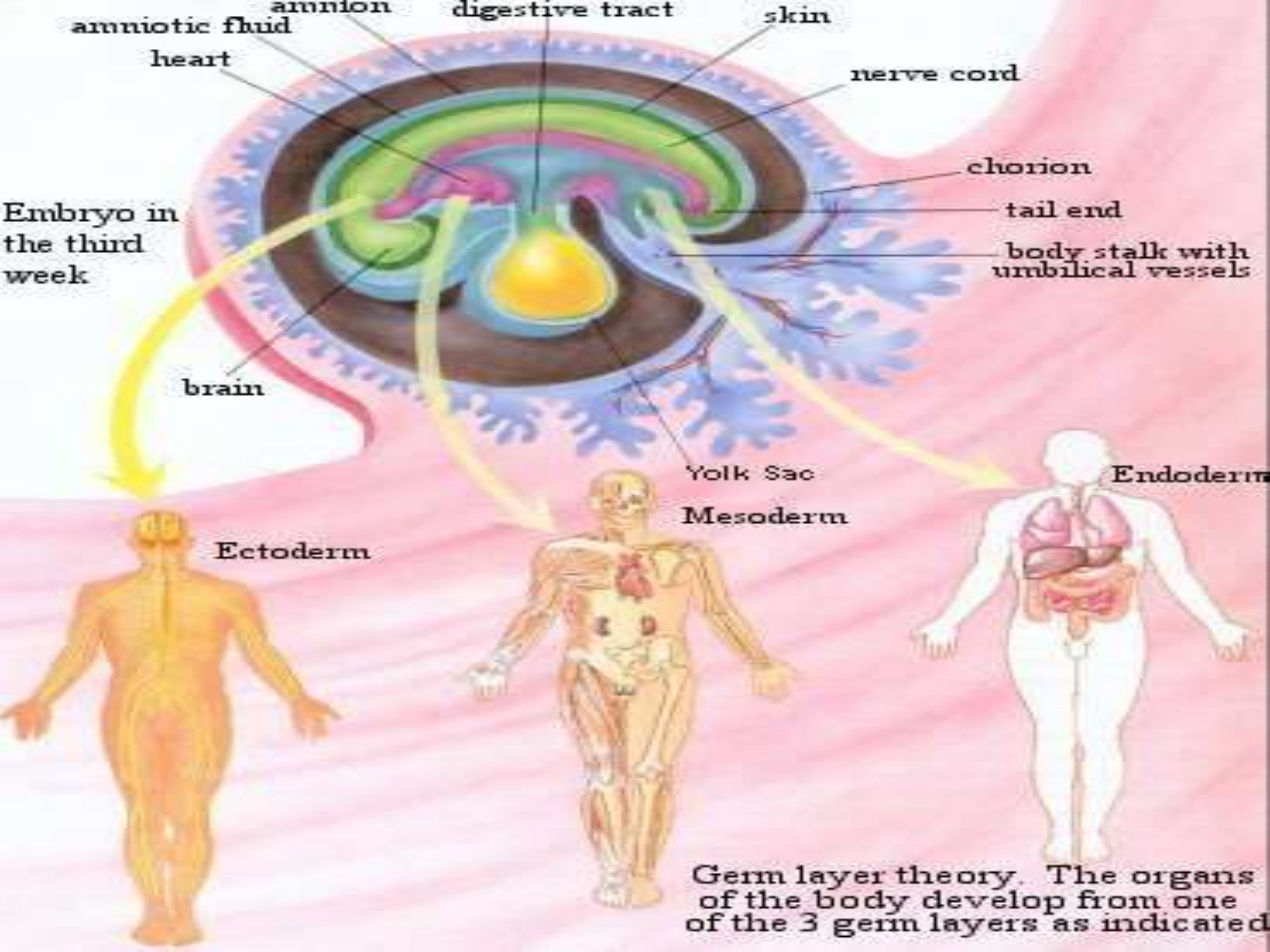
Introduction to Tissues

- The three embryonic germ layers are:

- 1.) Ectoderm (outside): It gives rise to
ET and NT.

- 2.) Mesoderm (middle): It gives rise to ET, CT
and MT.

- 3.) Endoderm (inside): It gives rise to ET.



Introduction to Tissues

- A liquid called ***Extracellular Fluid (ECF)*** surrounds all body cells.
- ECF has many functions including:
 - 1.) As a medium to dissolve solutes.
 - 2.) Transportation of nutrition and waste throughout the body
 - 3.) As a site for chemical reactions in the body.

Introduction to Tissues

- There are two types of ECF:

1.) ***Interstitial Fluid*** which fills the space between cells in tissues.

2.) ***Plasma*** which is the liquid portion of your blood

Cell Junctions

- A ***Membrane (Cell) Junction*** is a protein complex that holds layers of cells together to form tissues.
- There are two main functions of cell junctions:
 - 1.) To prevent intercellular leakage
 - 2.) To allow for transport between cells

Cell Junctions

- There are three types of cell junctions:

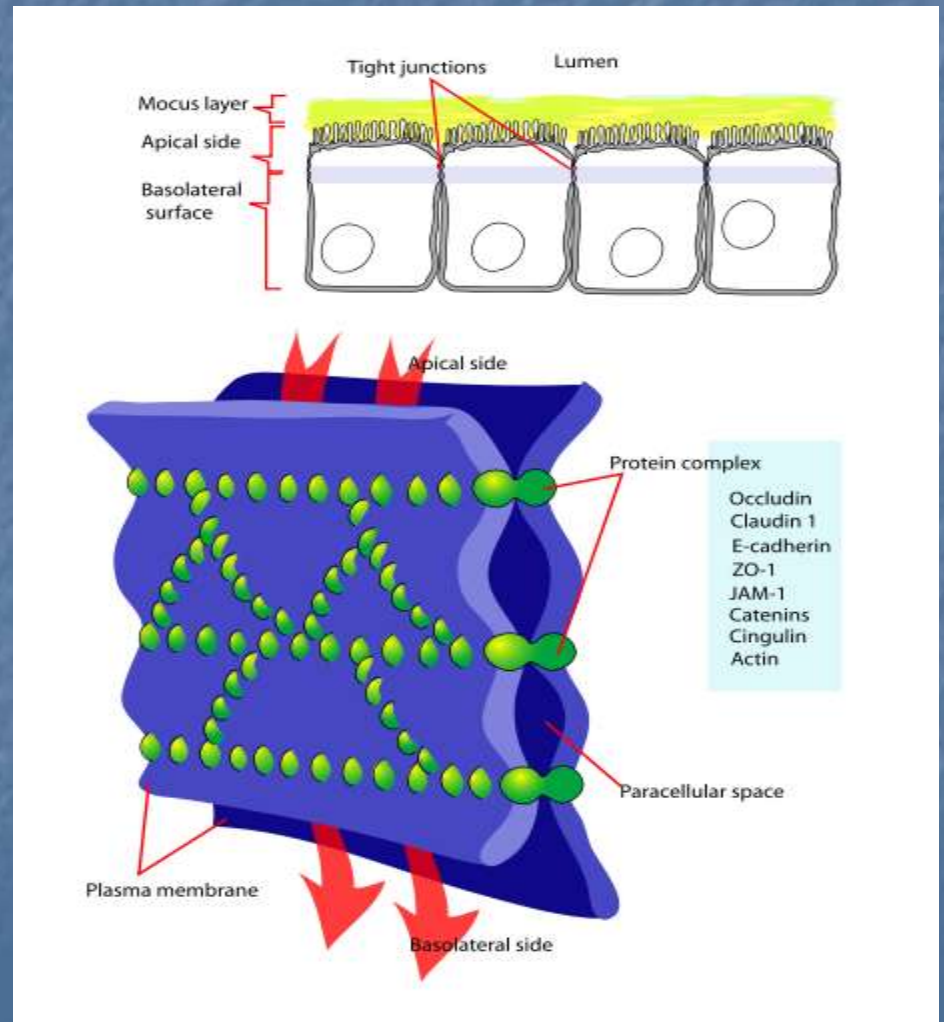
1.) tight junctions

2.) gap junctions

3.) desmosomes

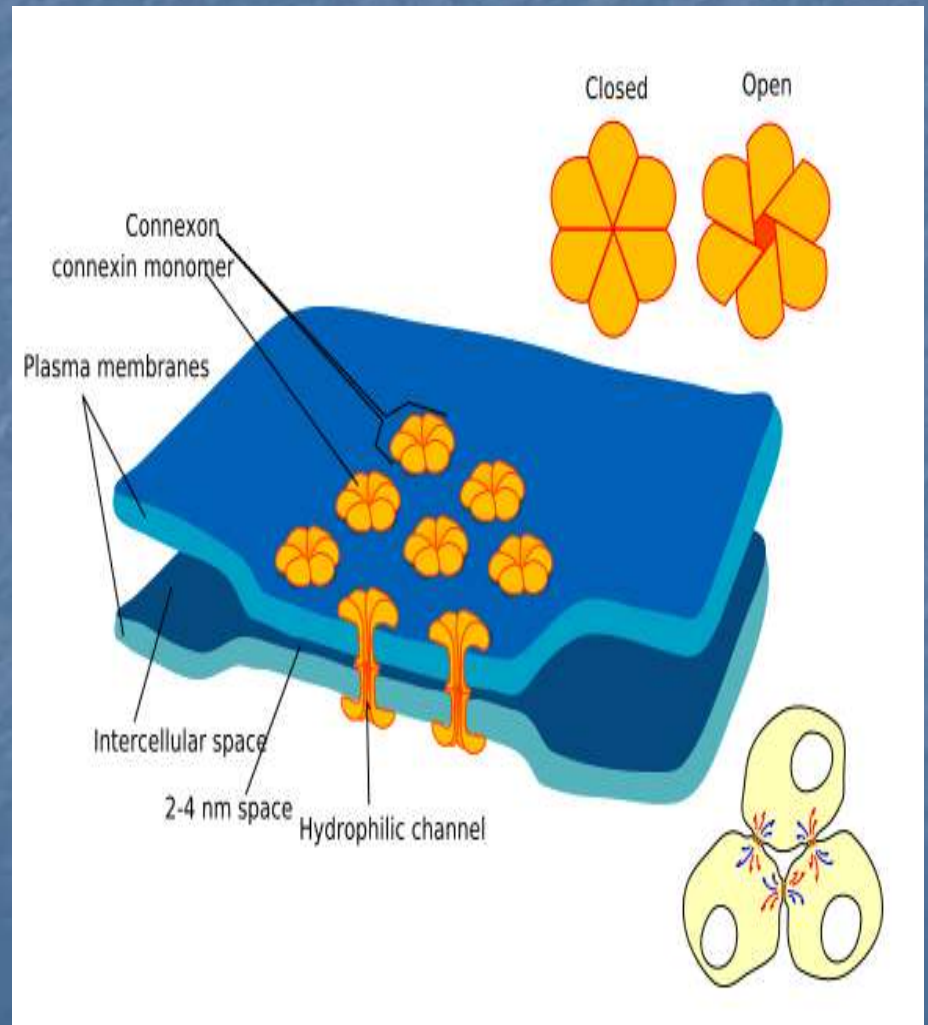
Cell Junctions

- ***Tight junctions*** are zipper like junctions between cells that prevent intercellular passage of materials.



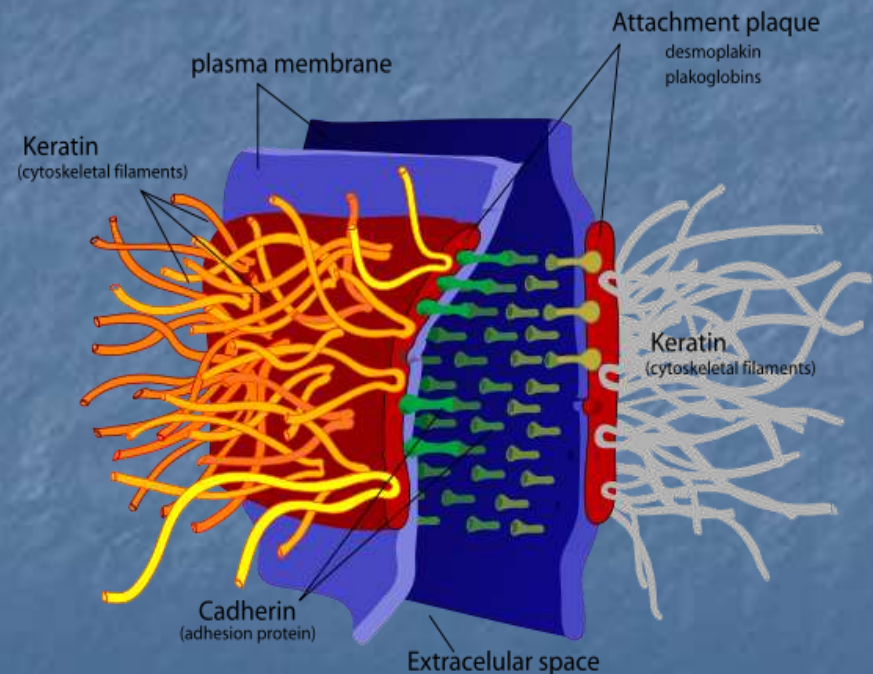
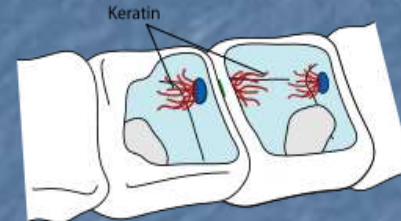
Cell Junctions

- ***Gap Junctions*** are junctions that have channels between adjacent cells that allow for transport of materials.



Cell Junction

- ***Desmosomes*** are junctions that anchor adjacent cells together.



Cell Junctions

- Cell junctions are the connections that allow for cells to group together into tissues.

Epithelial Tissue

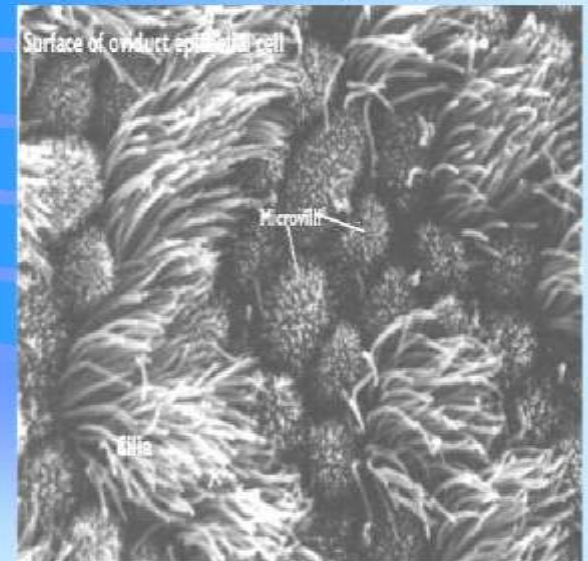
General Characteristics

- ET is found in tightly packed sheets with little intercellular material between them.
- ET always has a free surface called the ***apical surface***, which opens to the outside or to an open internal space.

Epithelial Tissue

- This free surface may possess modifications such as microvilli or cilia
- These are seen in the lining of your respiratory system among other places.

SEM view of cilia and microvilli



Epithelial Tissue

- The ***basal surface*** of ET is anchored to underlying connective tissue (CT) by a distinct “basement membrane”.
- ET **does not contain** any blood vessels it is fed by the underlying CT.
- ET has a high regeneration capacity...think about when you cut yourself!!!

Epithelial Tissue

- ET cover all body surfaces inside and out...they line internal body cavities, cover the outside of all organs and make up your skin or epidermis.
- ET has many functions including protection, absorption, secretion, excretion and filtration.

Epithelial Tissue

Classification of Epithelia

- ET is classified according to number of layers by the following terms:

Simple = single layer of cell

Stratified = many layers of cells

- ET is also classified by shape by the following terms:

Squamous = flattened cells

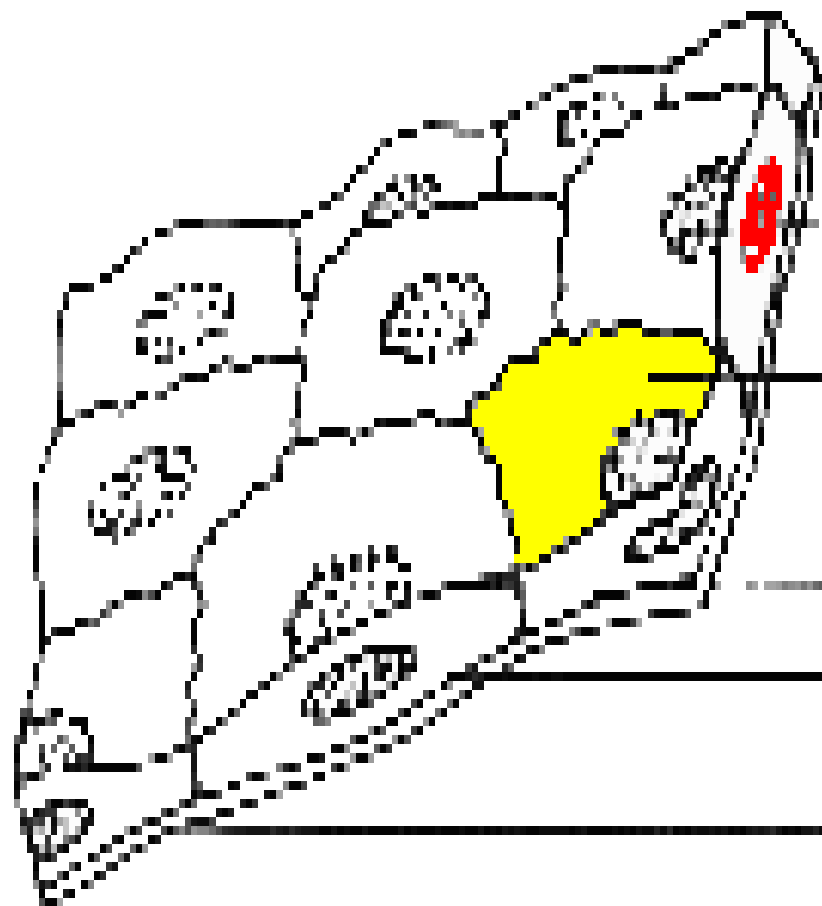
Cuboidal = square shaped cells

Columnar = elongated cells (like columns)

Epithelial Tissue

Types of Simple Epithelium

- ***Simple squamous epithelium*** is a single layer of flattened cells.
- It generally allows for easy passage or diffusion of materials.
- It is found in the linings of air sacs (lungs), capillaries (blood vessels), lymph vessels and body cavities.



nucleus

cytoplasm

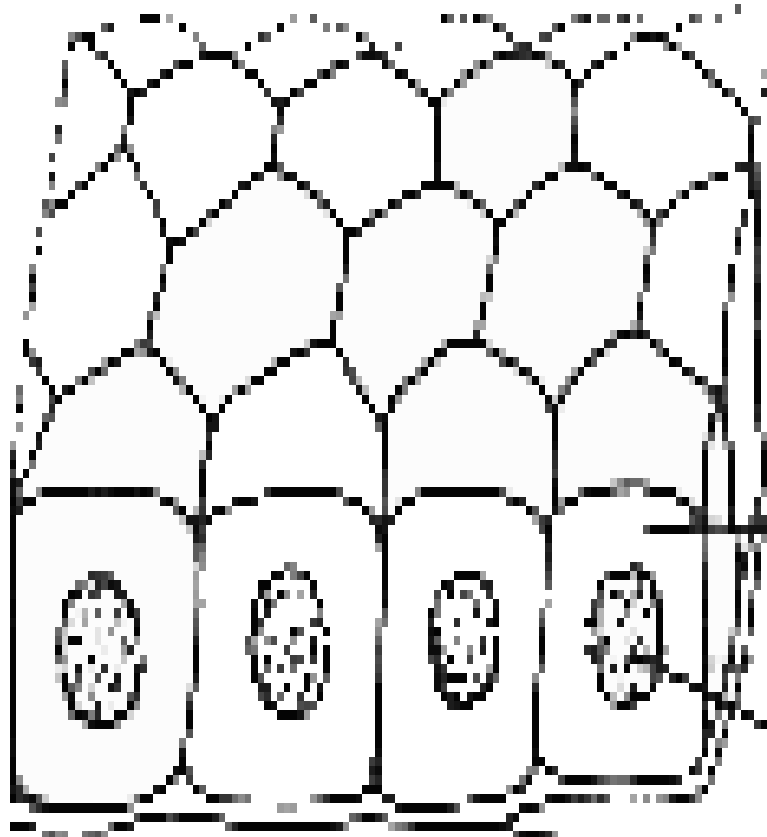
cell membrane

flat cell

basal lamina

Epithelial Tissue

- ***Simple cuboidal epithelium*** is a single layer of square shaped cells with centrally located nuclei.
- It allows for secretion and absorption of materials, or the in and out flow of materials.
- It is found lining kidney tubules, ducts of glands in the endocrine system and the surface of the ovaries.



columnar cells

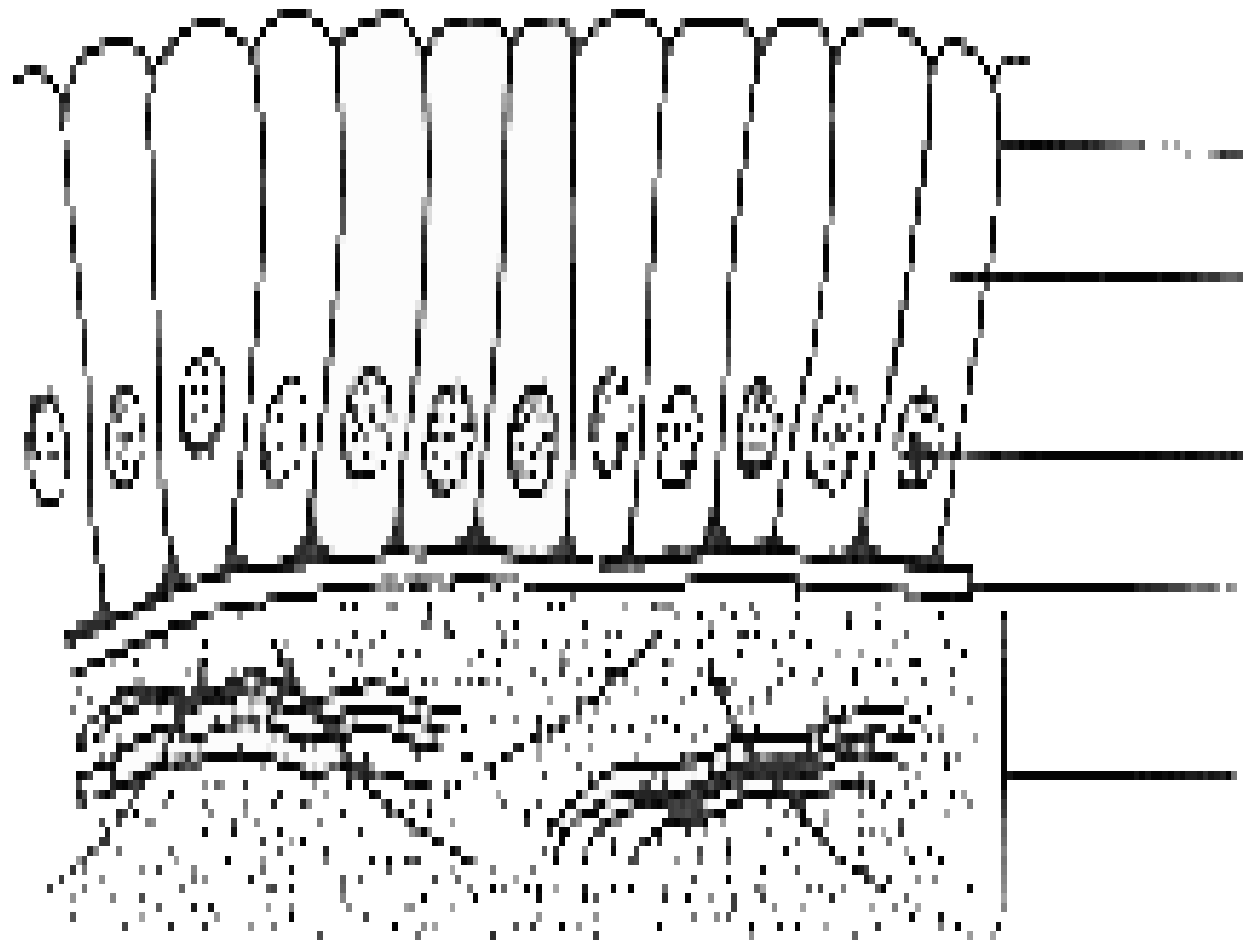
cuboidal cell

nucleus

basal lamina

Epithelial Tissue

- ***Simple columnar epithelium*** is a single layer of elongated cells with basally located nuclei (near the basement).
- Its functions include protection, absorption and secretion.
- It is found as the lining of the digestive tract and uterus
- It has microvilli and goblet cells (which function in producing mucus).



columnar cells

cytoplasm

nucleus

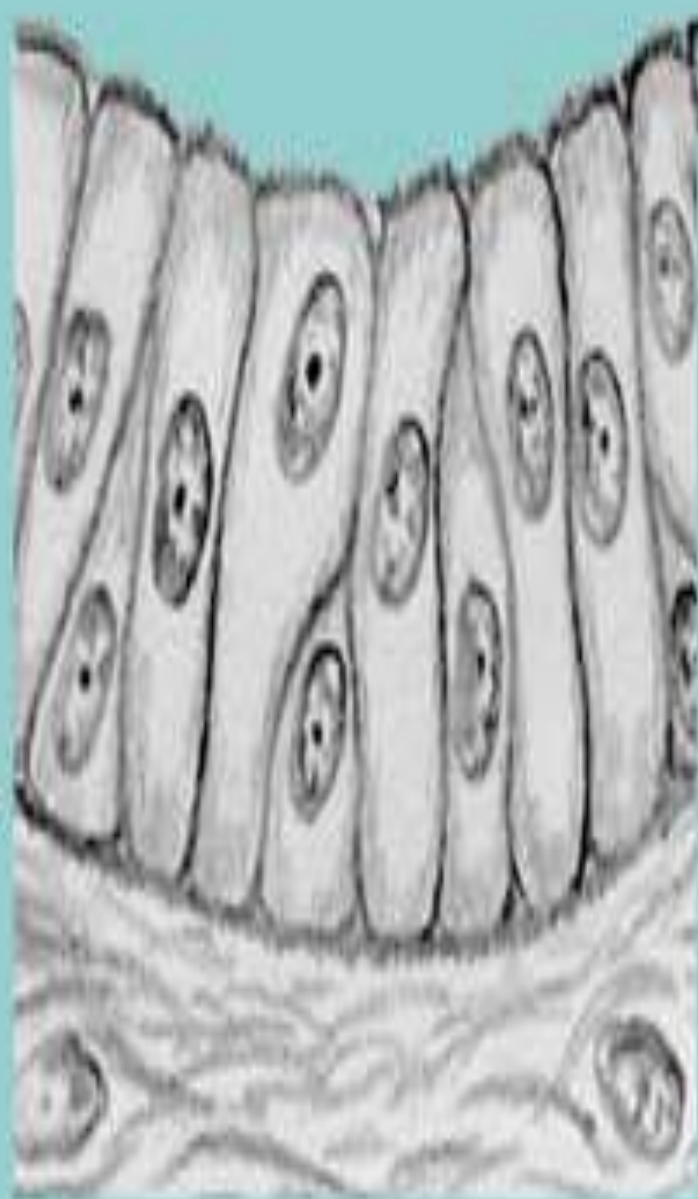
basal layer

connective tissue

Epithelial Tissue

- ***Pseudostratified columnar epithelium*** is a single layer of elongated cells with scattered nuclei...looks stratified but it's not.
- Its functions include secretion and protection.
- It is found lining the respiratory tract and the fallopian tubes.
- It has cilia and goblet cells. (Think about the danger of infection in the areas where it is found...these cells make 1 of the bodies lines of defense.)

Basement
Membrane →



Pseudostratified
Columnar Epithelium

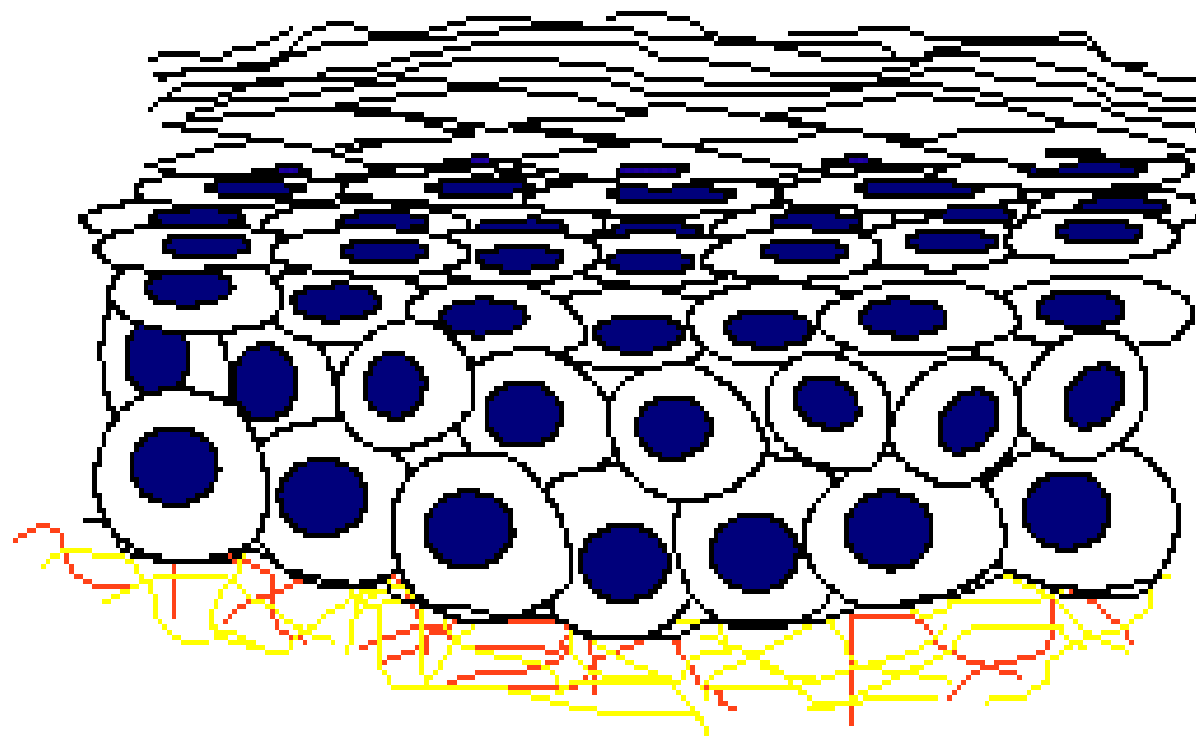
Dense Irregular
Connective Tissue

Epithelial Tissue

Types of Stratified Epithelium

- ***Stratified squamous epithelium*** is composed of many layers of flattened cells.
- It functions in protection.
- There are two sub-types of stratified squamous epithelium: 1.) Non-keratinized 2.) Keratinized
- Non-keratinized version is found lining the mouth, throat, vagina and anus.
- Keratinized version is found in the epidermis of the skin.

keratinized stratified squamous
dead, keratinized cells at surface



cells flatten
toward surface

↑
mitotic divisions

Epithelial Tissue

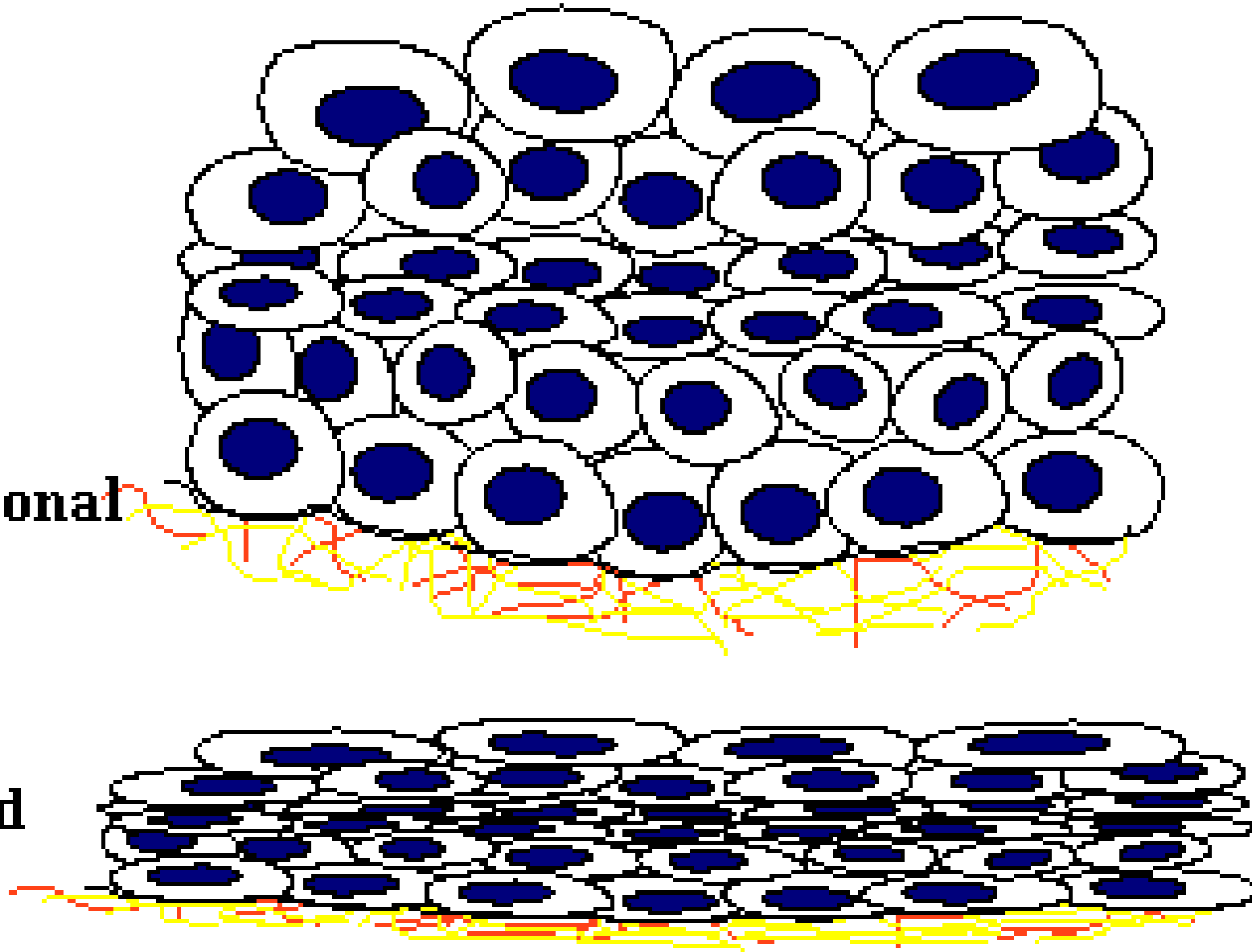
- ***Transitional epithelium*** is many layers of cells that change shape in response to tension.
- Its function is distensibility...or ability to distend or stretch.
- It is found in the urinary bladder.

large, ovoid surface cells

normal

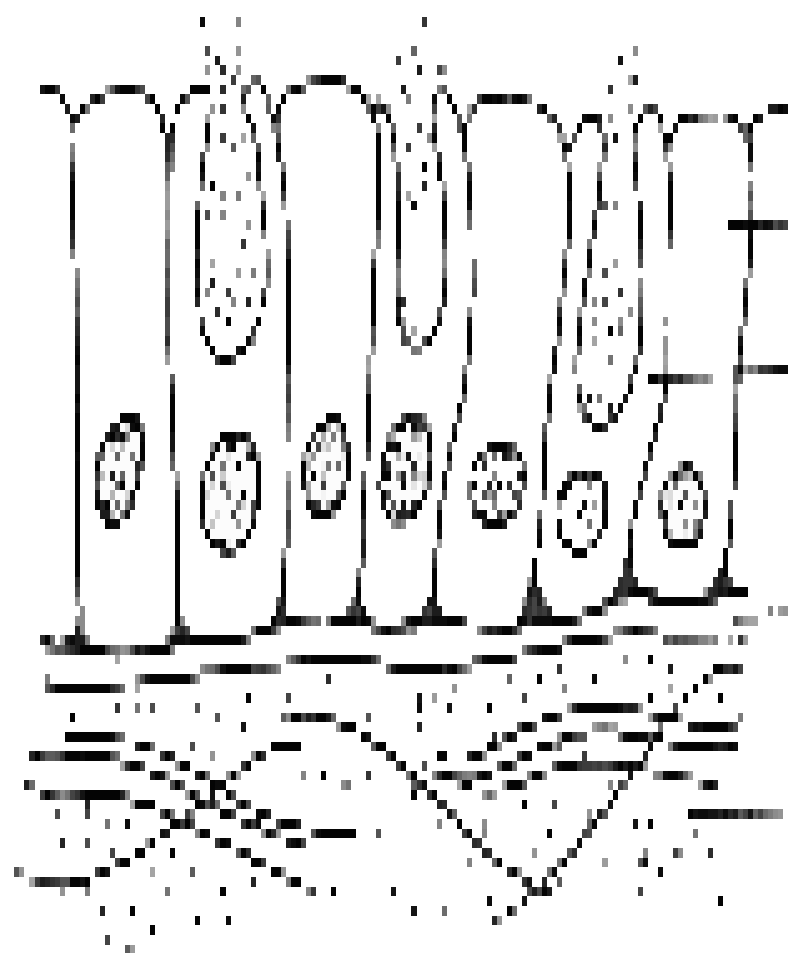
transitional

stretched



Epithelial Tissue

- ***Glandular epithelium*** which are usually simple columnar or cuboidal.
- Its function is secretion.
- There are two major types:
 - 1.) *exocrine glands* which secrete products into ducts such as sweat or gastric glands.
 - 2.) *endocrine glands* which secrete hormones into the blood.



columnar epithelium cells

goblet cells which secrete mucus

basal lamina

connective tissue

Connective Tissue

General Characteristics

- CT is primarily composed of cells and intercellular matrices.
- The type of CT varies by the proportion of cells to fiber to ground substances.

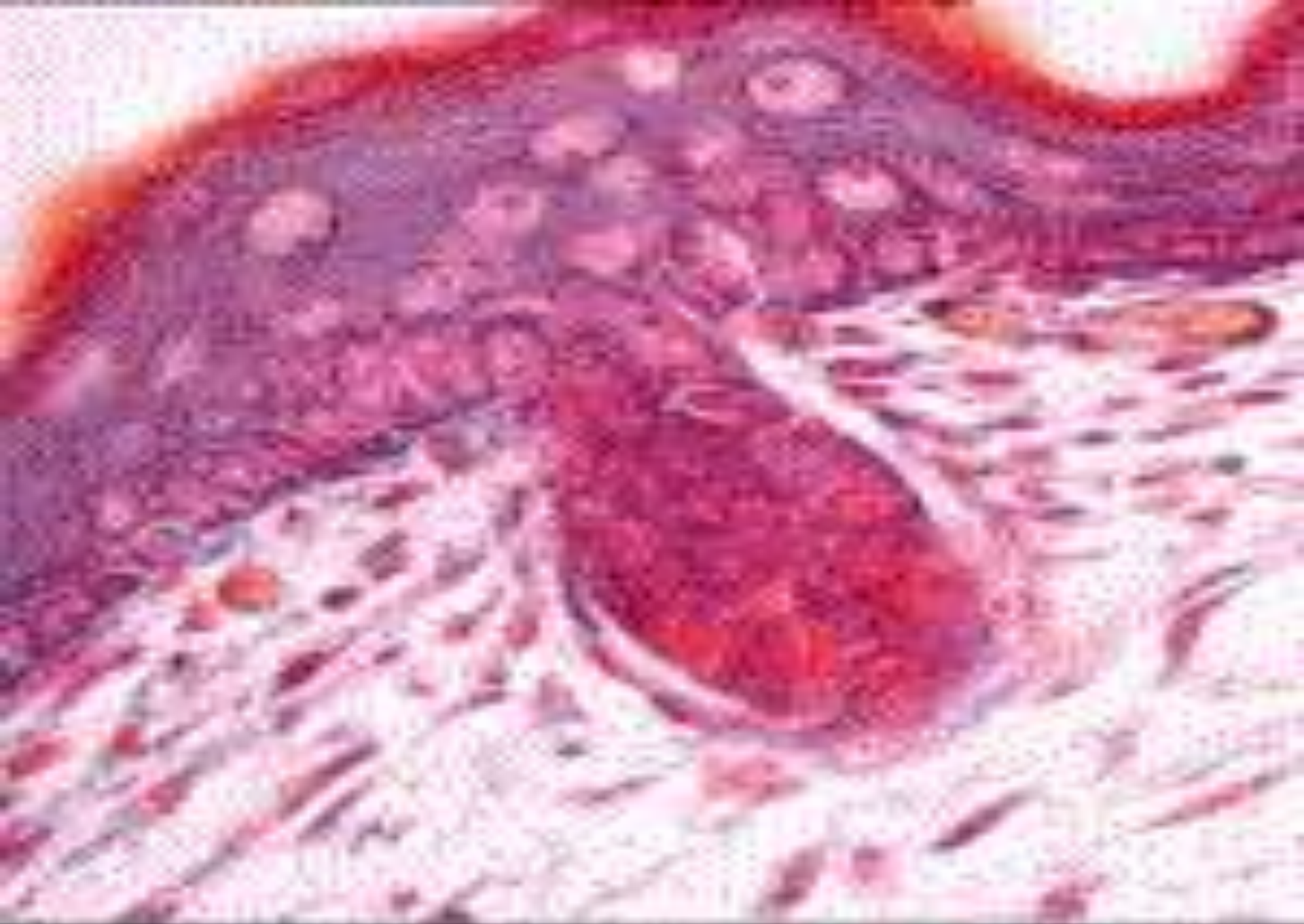
Connective Tissue

- The ***ground substances*** are the material that fills the space between cells and fibers...it filters nutrients and gases for impurities.
- The ***fibers*** are either collagen, elastic or reticular and they give the tissue strength
- The ***cells*** are either fundamental cells, “blast” cells or migrating white blood cells which carry out the tissues purpose.

Connective Tissue

Types of Connective Tissue

- Embryonic CT is located in the embryo.
- Its function is to give rise to all types of adult CT.



Connective Tissue

- There are five types of mature or adult CT:

- 1.) Loose Connective
- 2.) Dense Connective
- 3.) Cartilage
- 4.) Bone
- 5.) Blood

Connective Tissue

Loose Connective Tissue

- ***Loose fibrous CT*** is made up of a gel-like matrix with fibroblasts, collagen and elastic fibers.
- It is the layer below the ET and it surrounds organs.
- It wraps and cushions organs and allows for diffusion of nutrients and gas.
 - ***Diffusion*** is the random movement of particles from a high concentration to a low concentration.



Connective Tissue

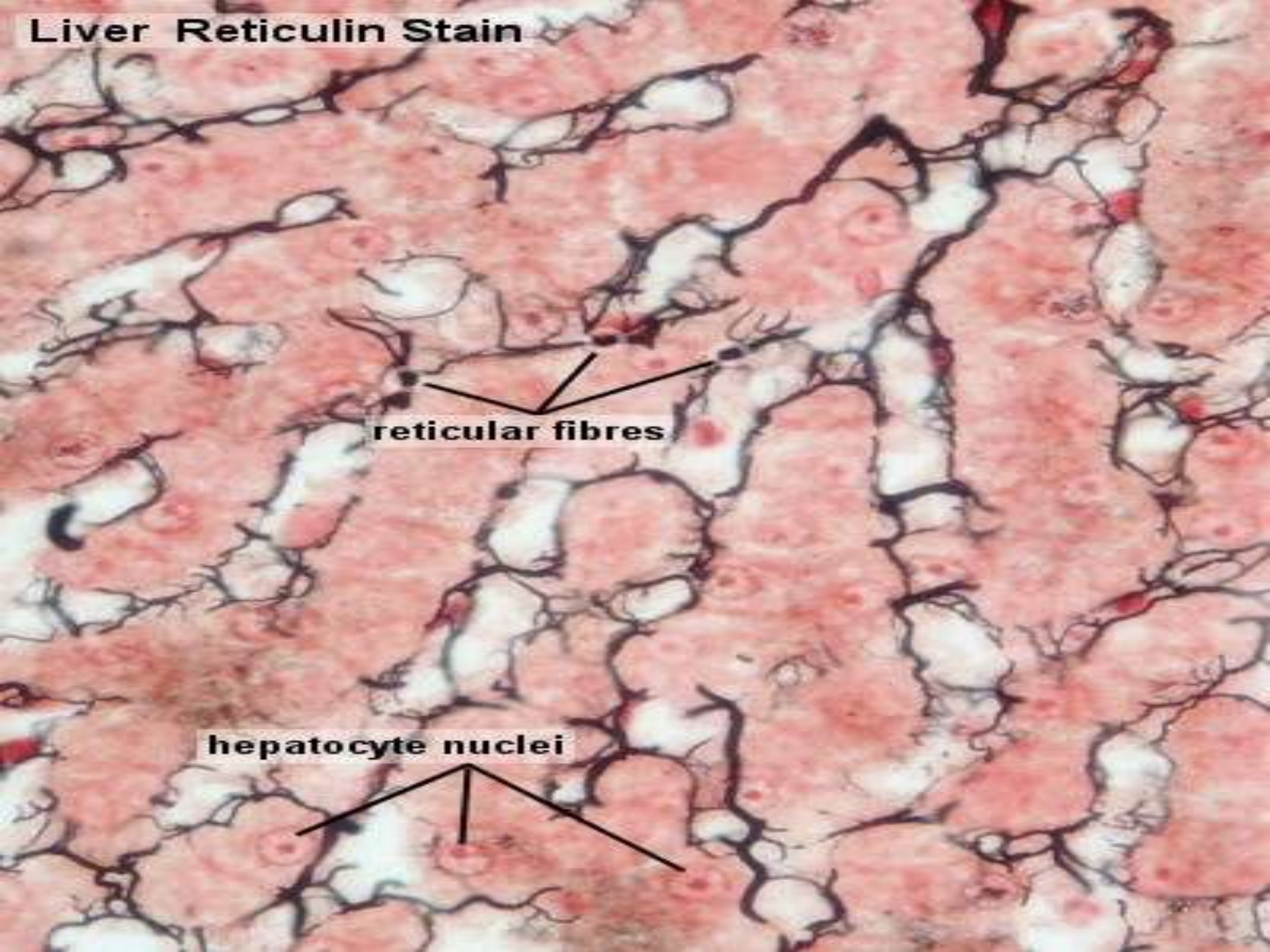
- ***Adipose tissue*** are closely packed adipocytes (fat cells).
- It is located under the skin, around the kidneys, eyeballs and breasts.
- Its major functions include energy storage, insulation and protection.



Connective Tissue

- ***Reticular CT*** is a network of reticular fibers with loose ground substances.
- It is located in lymph nodes, the thymus gland and the spleen.
- Its function is to support ET.

Liver Reticulin Stain



Connective Tissue

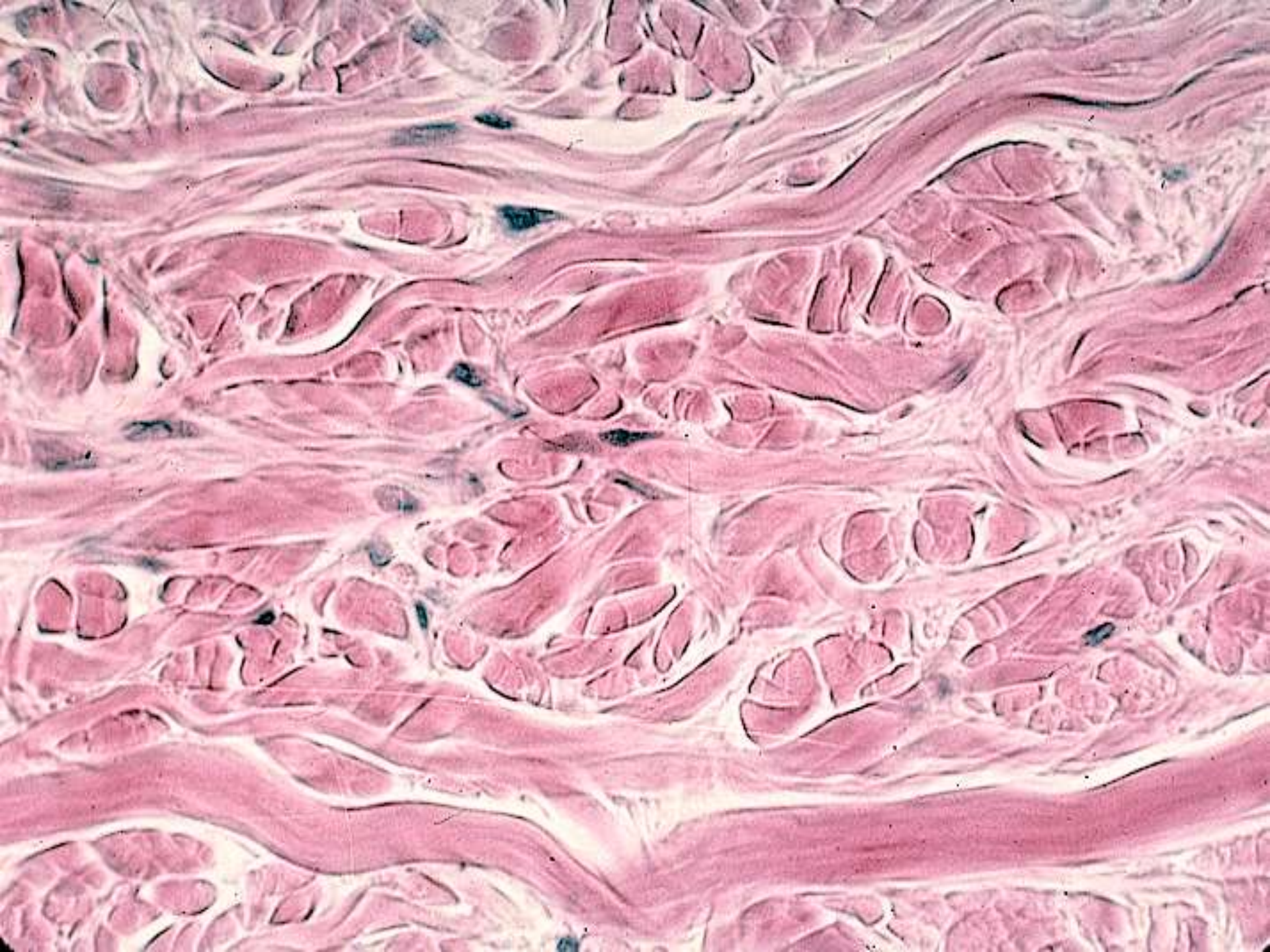
Dense Connective Tissue

- ***Dense regular CT*** is composed of primarily collagen fibers.
- They make up your tendons and ligaments.
- Their primary function is attachment and tensile strength.
- They heal slowly or not at all due to poor blood supply.



Connective Tissue

- ***Dense irregular CT*** is primarily composed of collagen fibers with a random arrangement.
- It is located in the dermis of the skin and the heart valves.
- It provides tensile strength.



Connective Tissue

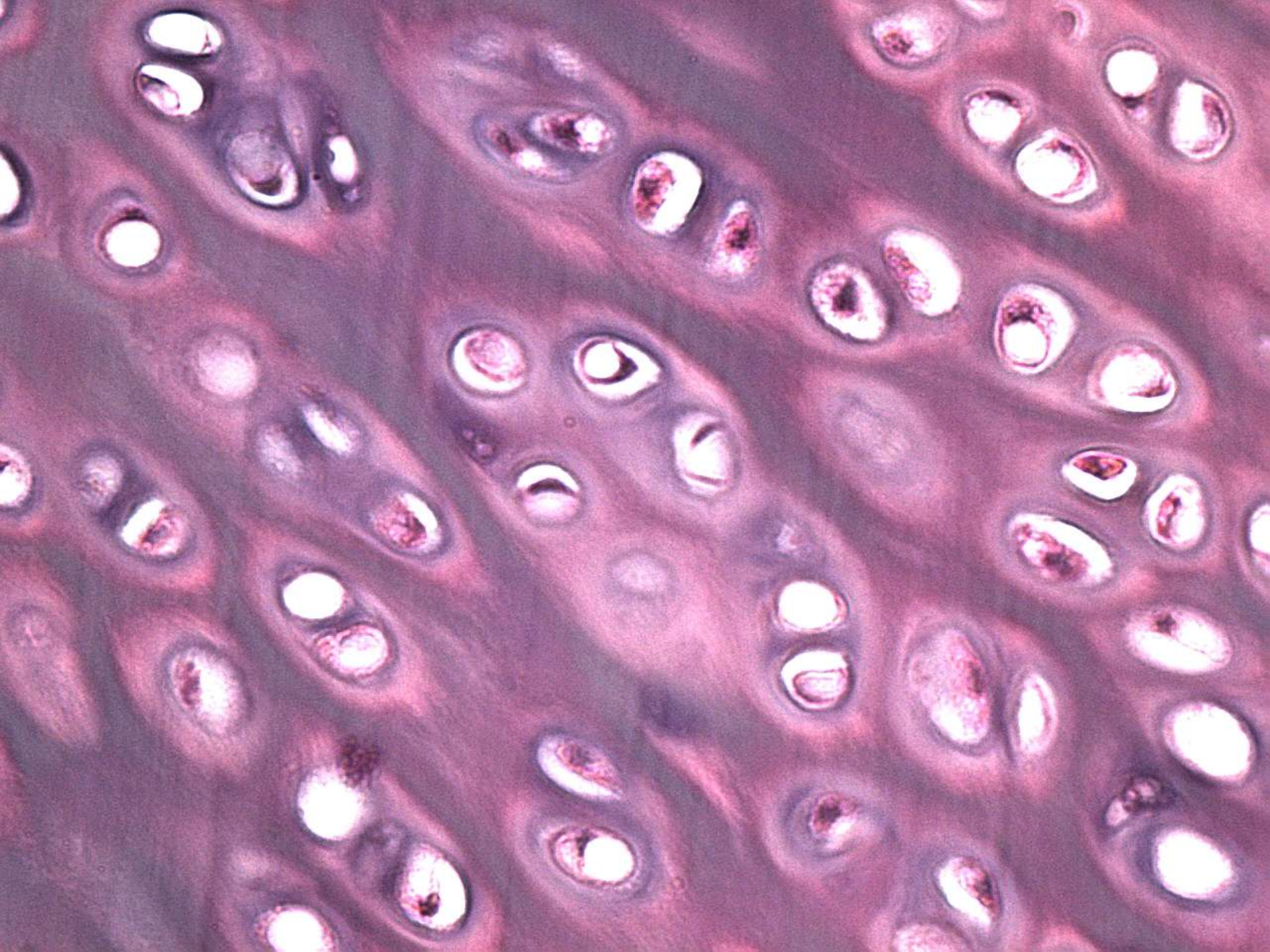
- ***Elastic CT*** is primarily made up of elastin fibers.
- It is found in the lung tissue and wall of the aorta.
- Its function is based on its durability with stretching.



Connective Tissue

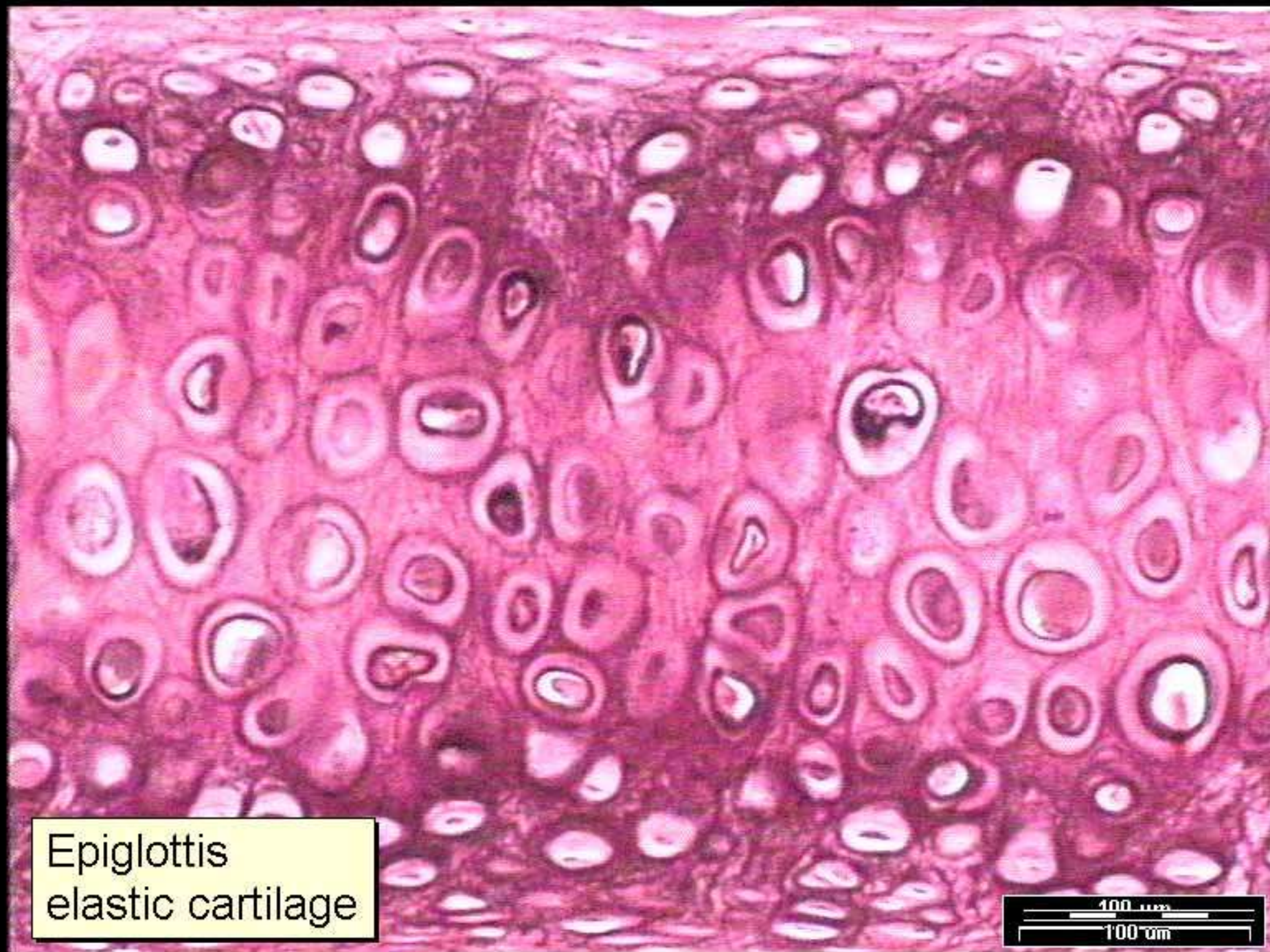
Cartilage

- ***Hyaline cartilage*** is an amorphous matrix that surrounds cells.
- It is located in the costal cartilage along with the cartilage of the nose, trachea and larynx.
- It provides support and structure.
- It has **NO** ability to heal because it is avascular.

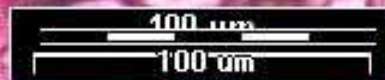


Connective Tissue.

- ***Elastic cartilage*** has the same make up as *Hyaline cartilage* but it also contains elastic fibers.
- It is located in the external ear and the epiglottis.
- It maintains a regular shape but it is also flexible.

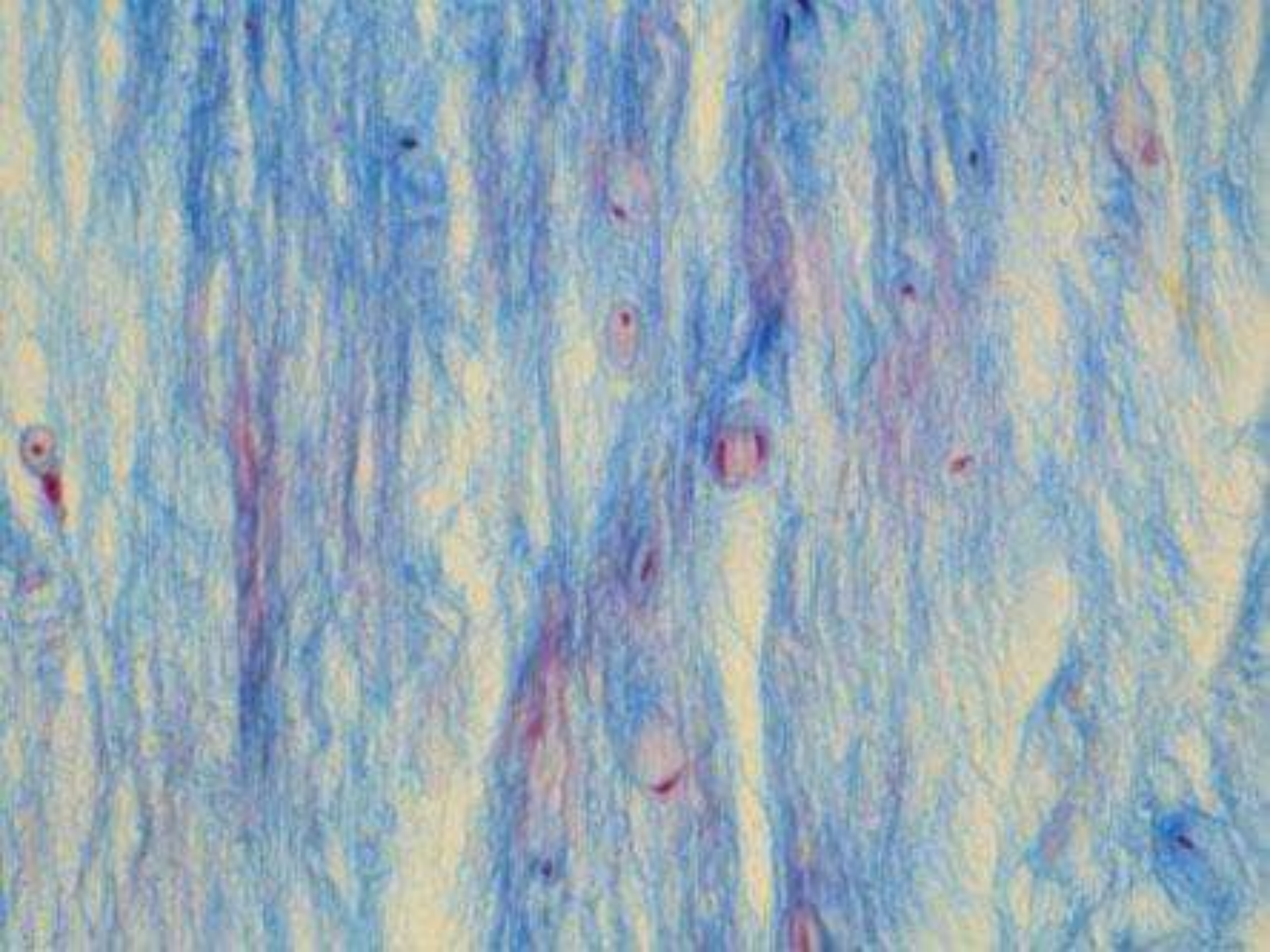


Epiglottis
elastic cartilage



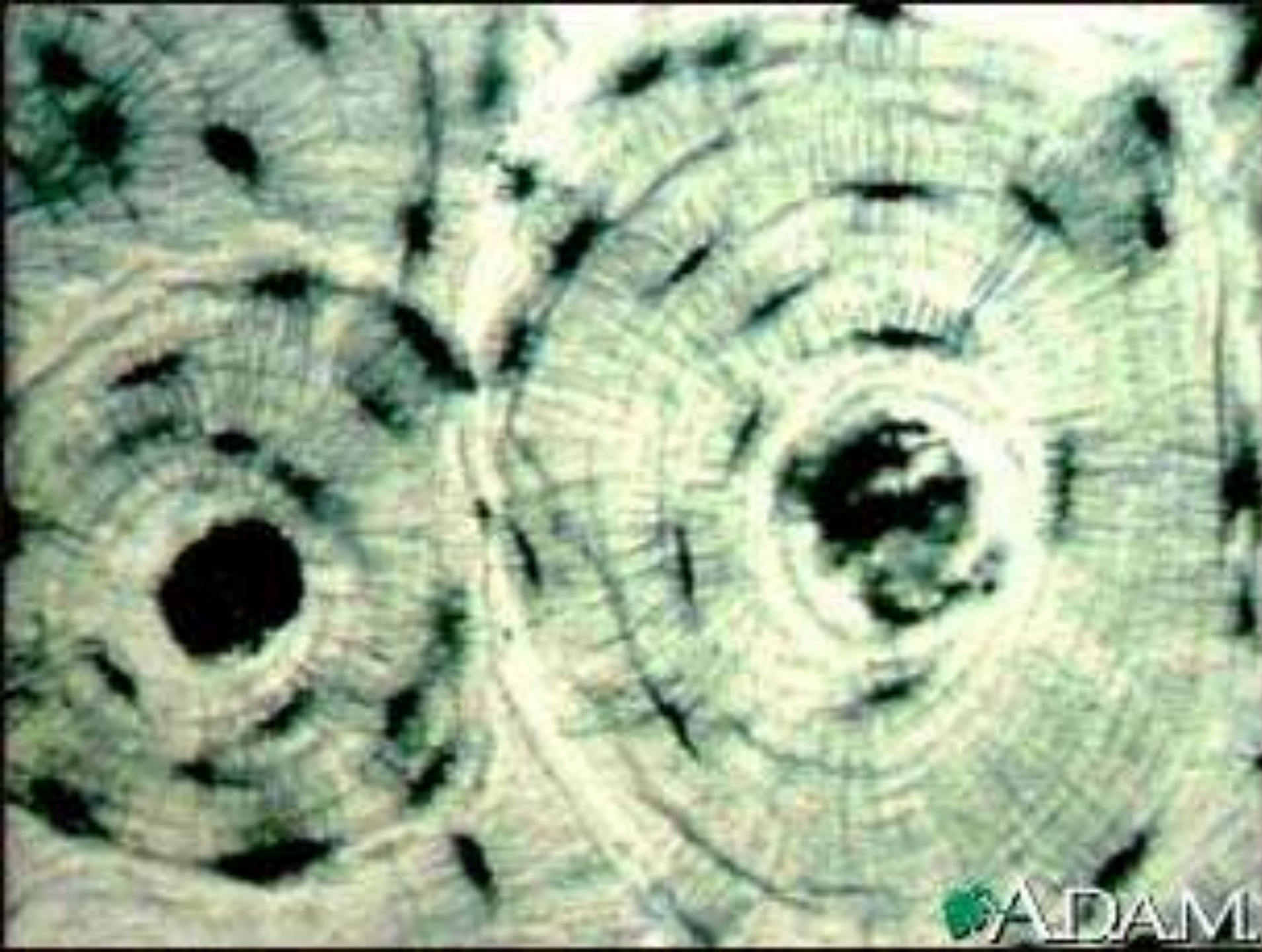
Connective Tissue

- ***Fibrocartilage*** is the same as the previous two except it is less firm than *Elastic cartilage*.
- It is located in the intervertebral discs.
- It functions as a sort of shock absorber.



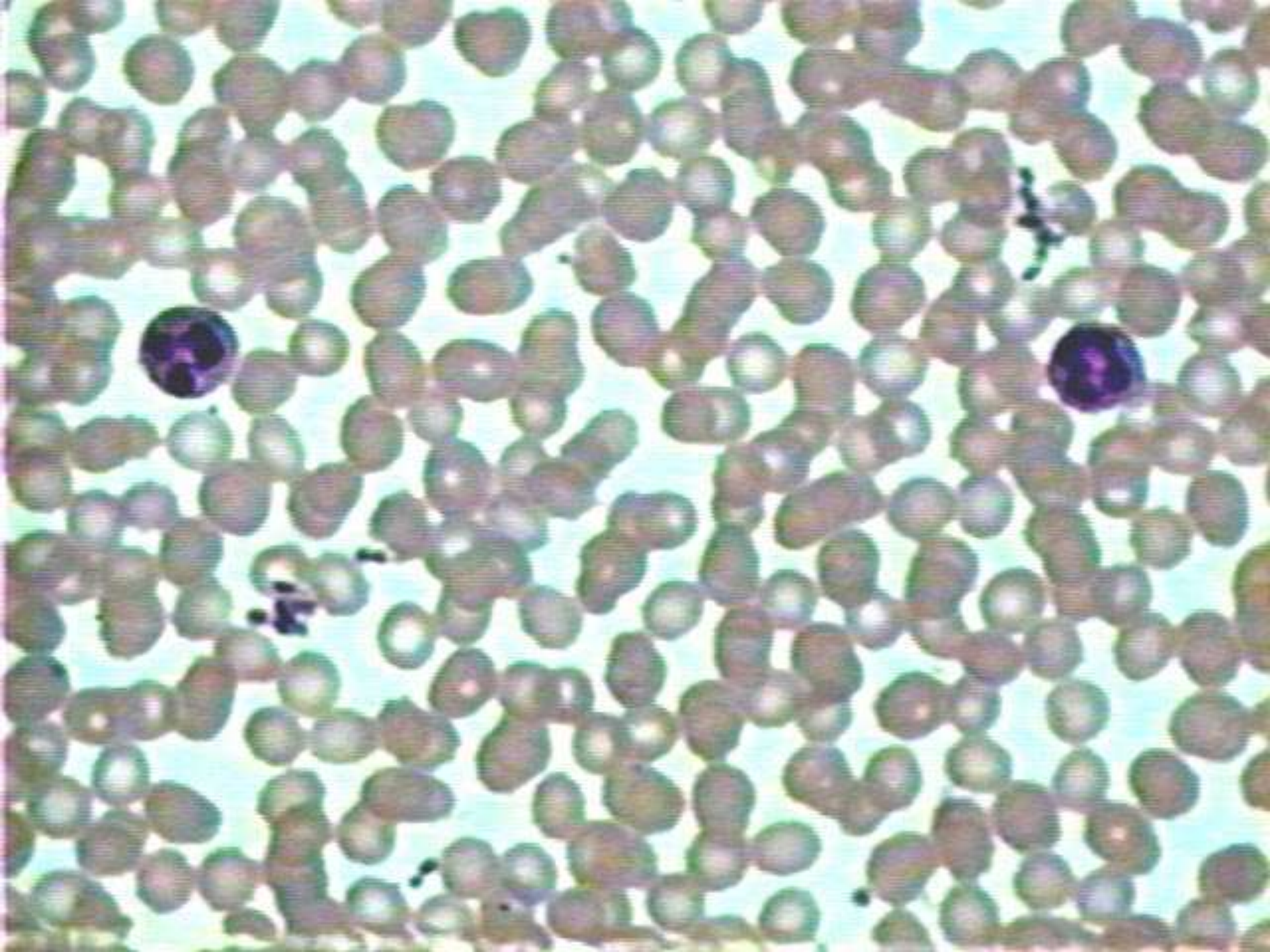
Connective Tissue

- ***Bone*** is made up of a hard calcified matrix with collagen fibers and cells called osteocytes.
- Osteocytes make up the bones.
- It offers protection, support, movement, calcium storage and hematopoiesis (produces blood cells).
- Heals very quickly because it is highly vascularized.



Connective Tissue

- ***Blood*** is made up of red blood cells, white blood cells and platelets contained in a fluid matrix called plasma.
- It is found with in the vascular system.
- It transports gases, nutrients and waste.



Muscle Tissue

General Characteristics of MT

- All muscle cells have elongated shape...that's why they are called muscle fibers.
- Muscle fibers are contractile.
Contractile means they change their shape by shortening to cause their attachments to move.

Muscle Tissue

- There are three types of muscle tissue:

1.) Skeletal Muscle

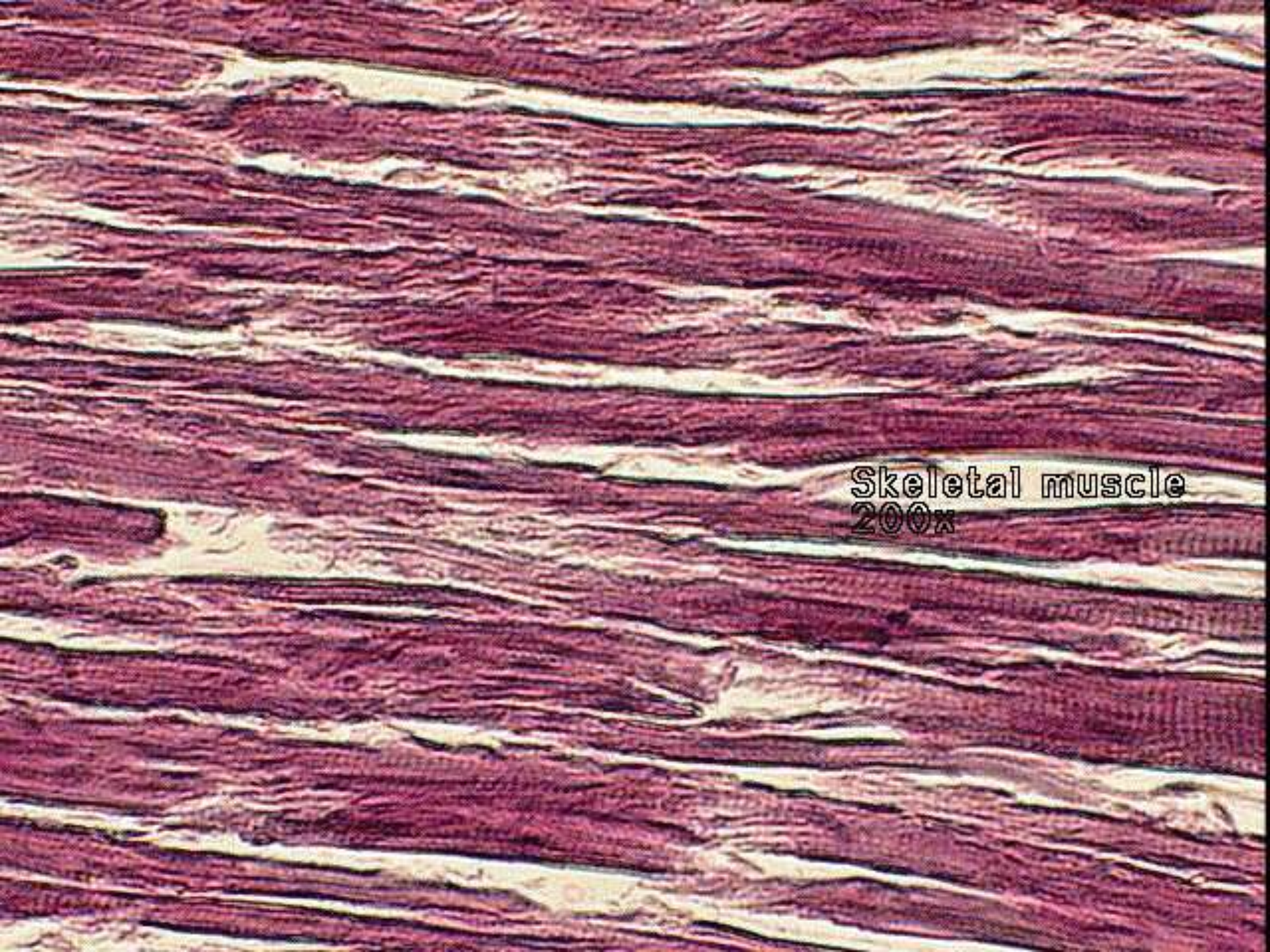
2.) Cardiac Muscle

3.) Smooth Muscle

Muscle Tissue

Skeletal Muscle

- ***Skeletal muscle tissue*** is characterized with a long thin structure (fibers) with many nuclei.
- These fibers have alternating areas of light and dark muscle called striations.
- They are attached to bones.
- They move the bones of the skeletal system.
- They work on voluntary control meaning you can consciously move them.

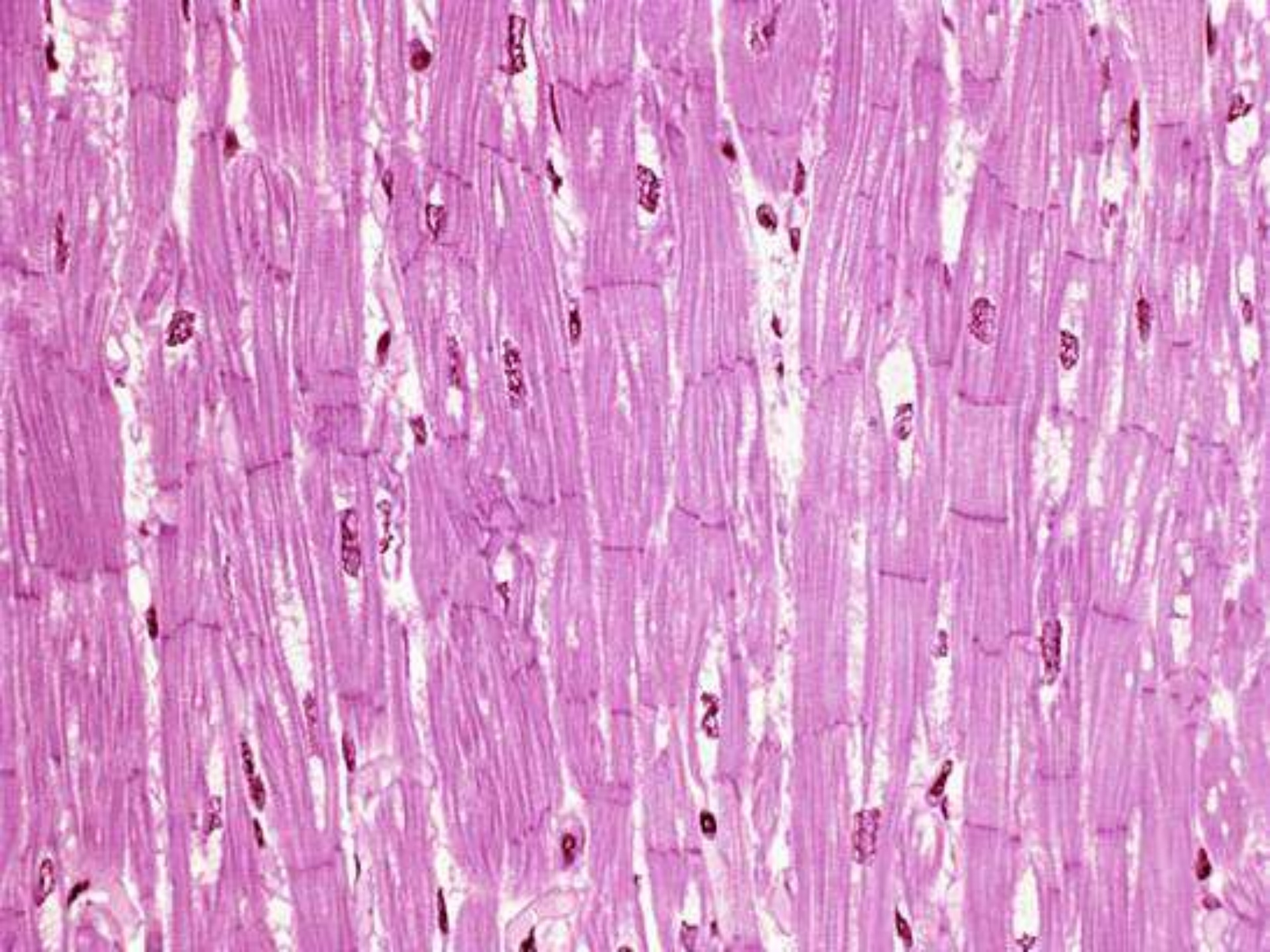


Skeletal muscle
200x

Muscle Tissue

Cardiac Muscle

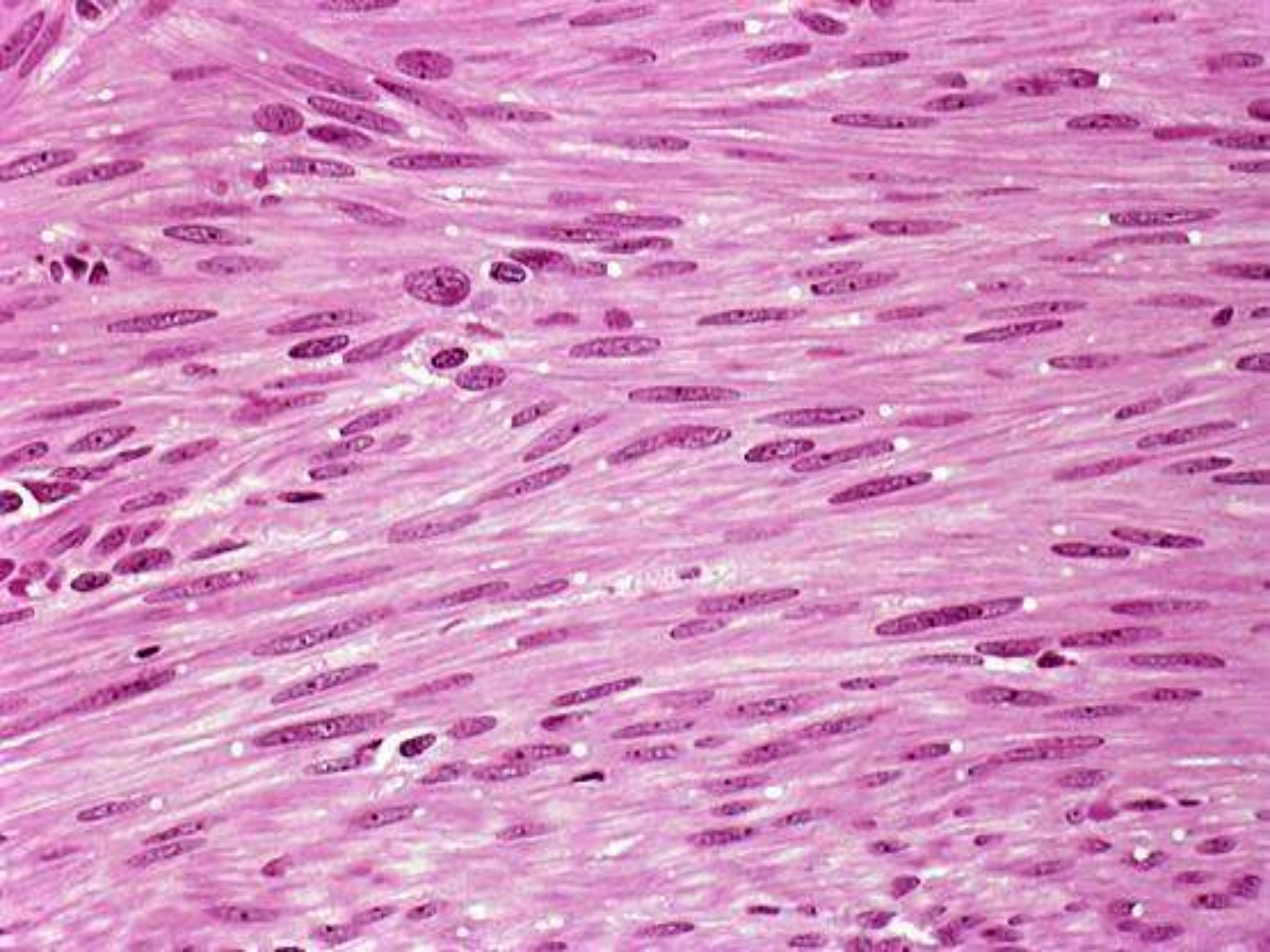
- ***Cardiac muscle tissue*** is characterized by a network of cells with a centrally located nuclei.
- The space where two cells meet is called an intercalated disc which allows the electrical signal to pump from cell to cell.
- It makes up the heart.
- Its function is to pump blood to the lungs to pick up oxygen and then to pump the oxygenated blood around the body.
- It is controlled involuntarily...you can't stop our heart by thinking about it.



Muscle Tissue

Smooth Muscle

- ***Smooth muscle tissue*** is characterized by spindle shaped with a centrally located nucleus and **NO** striations.
- It is located in the walls of hollow visceral organs and the walls of blood vessels.
- It is responsible for moving food through the digestive tract, expelling urine and constricting blood vessels.
- It is both voluntary and involuntary depending on the function it is responsible for.



Nervous Tissue

Nervous Tissue

- The primary cell that makes up nervous tissue is called the **neuron** which responds to changes in their surroundings.
- The tissue is made up of neurons and neuroglia which act as support cells to the neurons...they feed them and remove their waste.
- Nervous tissue is found in the brain, spinal cord and nerves.
- It is responsible for coordinating your body parts and functions.
- There is **NO** reproduction of these cells.

